

## Research Highlight

Filling a gap in the picture of tropical clouds, a research team led by Pacific Northwest National Laboratory (PNNL) combined two views of clouds in the tropical Indian Ocean. Using collocated precipitation and cloud radar measurements, they developed a seamless data set that represents the full spectrum of tropical clouds. This data set holistically describes all cloud types in the tropics, including heavily precipitating clouds, permitting a clearer picture of their influence on the climate.

Observing heavily precipitating clouds, abundant in the tropics, has always been limited by the cloud radar measurement system, creating gaps when tropical storm clouds occur. Researchers from PNNL, Texas A&M, and the National Center for Atmospheric Research compared collocated measurements obtained from a scanning precipitation radar and a vertically pointing cloud radar during the Atmospheric Radiation Measurement (ARM) Climate Research Facility's Madden-Julian Oscillation Investigation Experiment (AMIE) Field Campaign. Their research characterized the strengths and weaknesses of both systems in detecting a variety of cloud types. When heavily precipitating clouds occur, the cloud radar signals are weakened and failed to penetrate to the cloud top. Precipitation radar profiles filled in the gaps, creating continuous profiles of both precipitating and non-precipitating clouds. The new data set improves the representation of the retrieval of cloud microphysics and radiative heating rates in all sky conditions.

This data product has already been used in the research community to improve understanding of tropical convection, which is a major source of uncertainty in all climate models.

Tropical storm clouds have been called the engines of the climate, so scientists want to understand how they form and influence the complex physical phenomena that move water and heat through the atmosphere. Cloud and precipitation radar instruments installed and operated by the U.S. Department of Energy's ARM Climate Research Facility, located in the tropics, take continuous measurements of clouds. The research detailed in this paper plugged some gaps in the cloud data, providing a more complete view for future cloud research.

## Reference(s)

Feng Z, SA McFarlane, C Schumacher, S Ellis, J Comstock, and N Bharadwaj. 2014. "Constructing a merged cloud-precipitation radar dataset for tropical convective clouds during the DYNAMO/AMIE experiment at Addu Atoll." *Journal of Atmospheric and Oceanic Technology*, . . ONLINE.

## Contributors

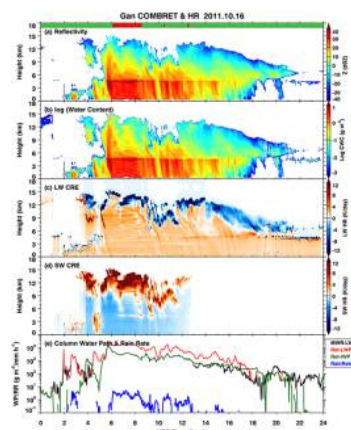
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## Working Group(s)

Cloud Life Cycle



In the tropics, large thunderstorm clouds can grow into huge towers that flatten at the lower boundary of the stratosphere and form an anvil shape. This image, taken from the International Space Station over western Africa in 2008, shows the three-dimensional and multi-layered nature of these cloud systems. Photo courtesy of NASA's Earth Observatory.



An example of the merged radar product, from top to bottom: merged radar reflectivity, total water content, longwave cloud radiative effect, shortwave cloud radiative effect, liquid/ice water path and surface rain rate.